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Perspectives of Students Towards Challenges with Learning Mathematics Online: A Qualitative Analysis in Trinidad and Tobago

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ABSTRACT

The outcry and dissatisfaction from some students at the beginning of a Mathematics course online have been consistent over the years. Their disenchantment is a consequence of their lack of self-confidence and motivation in the study of Mathematics online. The viewpoints and sentiments were generated by undergraduate students who were enrolled in a general education foundation course in Mathematics at Prosperous University in Trinidad and Tobago. A review of the literature demonstrated there is a dearth of information at the local level. This gap in the literature prompted the authors to adequately investigate the experiences of these students regarding this dislike for the learning of Mathematics online. A qualitative methodology, which included a phenomenological approach was used. Seventy-two students completed semi-structured questionnaires, which were distributed through the Google Meet Learning Management System. The original four-step thematic analytical approach was used to interpret the data. These were validated by three experienced researchers in the teaching of Mathematics at the tertiary level. It ought to be noted that the participants responded comprehensively and honestly on the diverse factors that challenge their learning of Mathematics through the virtual mode of delivery. Results indicated that self-concept is the major determinant of achievement in online Mathematics. Recommendations strongly suggest how teaching and learning Mathematics online could be enhanced.

KEYWORDS: *Learning Mathematics, phenomenology, online learning, self-concept*

INTRODUCTION

"I really do not like Mathematics online!" "I cannot wait for this online course to be over!"

"I am terrified of Mathematics online!" These sentiments were expressed by the majority of students at the beginning of the very first session. The rapid shift from face-to-face to the virtual learning model inevitably heightened apprehensiveness and trepidation among undergraduate Mathematics students at Prosperous University. This scenario was further exacerbated since there were already challenges that grossly hindered these students who tried to complete the course successfully. Therefore, this qualitative study highlighted some of the major factors that hampered the learning of these seventy-two undergraduate students. A review of the literature indicated that low self-concept is the major factor that hinders students from being successful in studying Mathematics online.

This research question guided the study. What challenges do undergraduate students experience when learning Mathematics online? The findings will benefit students, educators, and educational institutions. The overall self-concept of students will be boosted and their achievement and performance in learning Mathematics online will be increased. Further, educational institutions can provide institutionalized strategies for addressing and enhancing the self-concept of students. Educators can also apply the recommended approach derived from the findings to improve their online pedagogies.

The results from this study can doubtlessly assist students to meaningfully confront their various challenges and thus be successful in learning Mathematics online. They can also be influential in assisting policymakers. The results can motivate other researchers to facilitate workshops and seminars and thus, enhance the teaching and learning of Mathematics online. Additionally, teachers can utilize the information herein to update their online teaching pedagogies. Moreover, providers of tertiary education can implement the recommendations and create institutionalized strategies to assist students with building their self-concept and improving their achievement status. This paper also highlighted the implications, and limitations, and presented recommendations for future research.

LITERATURE REVIEW

Baticulon et al. (2021) and Fabito et al. (2021) are well known for highlighting the challenges to online learning during the COVID-19 pandemic. According to Bringula et al. (2021), the

diverse hurdles that many students experience in learning Mathematics online still need further evaluation. They postulated that students who study Mathematics online need to have a solid self-concept. If this self-esteem is absent, they become easily disenchanted and disillusioned and proper learning is grossly hampered. To complement the teaching and learning of Mathematics online students need constant support and motivation. The frequent practice of content exercises serves to boost their self-concept. This shift from face-to-face to online learning platforms sometimes does not adequately boost the self-esteem of some students. For most students, this shift to an online learning platform required major changes in their approach and learning resources. Factors such as access to adequate devices, reliable internet services, private and non-distracting physical learning space, and strong habits of learners' autonomy were key to success in the study of Mathematics. Salac and Kim (2016) firmly believed that online learning caused a digital divide and did not properly facilitate the teaching and learning of Mathematics. This scenario is further compounded in developing countries that do not enjoy proper connectivity.

Bandura (1977a) posited that proper self-concept is fundamental to the learning process. Educators need to understand the importance of self-concept and its relevance to learning. They also need to appreciate how students learn. When these are accomplished, they can inform relevant teaching strategies. Moreover, they can enhance and motivate students to be successful in the study of Mathematics online. Hence, the following three theories, Behaviorism, Cognitivism and Social Constructivism were carefully selected.

Behaviorism

A review of the literature (Eggen & Kauchak, 2012, Skinner, 1945, Watson, 1957, & Yilmaz, 2011) revealed that Behaviorism promoted and affirmed the historical teacher-centered approach to education and was used by educators to shape curriculum, instruction and assessment globally. Practices such as rote learning, multiple choice items for assessment, and 'sage on stage' are all associated with this theory. As a result, several advantages and disadvantages accrued in teaching and learning situations. Some advantages associated with this legacy of learning are focused instruction and assessment and completing learning experiences as stated in a program outline within the time given for instruction (Araiba, 2019). Some limitations of this theory are the inability of students to apply learning in everyday life situations and it hinders the development of deep and critical thinking, to name a few (Araiba, 2019). As a result of these limitations, cognitivism emerged.

Cognitivism

Anderson, Reder and Simon (1997) affirmed that students adopt an individualistic approach to their learning activities. This theory is also encouraged by Cobb and Bowers (1999). The Cognitive Learning Theory also posits that students learn when they actively engage and participate in content acquisition. Eggen and Kauchak (2019), emphasized the importance of memory, attention and problem-solving among students. It also views learning as an active process of acquiring, organizing, and using information. Some teaching and learning strategies associated with this school of thought are chunking information, using mnemonics as memory cards, and modeling to ensure learning takes place (Yilmaz, 2011). For example, educators may teach an algorithm such as PEMDAS (Parentheses, Exponents, Multiplication, Division, Addition and Subtraction) as a general method to solve problems with multiple operations. Cognitive School allows students to use information to solve other problems that occur in everyday life activities. A major advantage associated with this school of thought is that it helps students to develop mental constructs. It also boosts critical thinking skills, enhances problem-solving abilities, encourages self-learning, improves memory retention, and strengthens understanding of concepts (Eggen & Kauchak 2019).

Although this school does not strongly emphasize emotional influence, it must be noted that emotions are significant in how students process and remember information. The over-emphasis on mental processes often focuses too much on thinking and memory and diminishes other aspects of learning that can be equally important. The lack of cultural considerations is also grave because it does not fully appreciate various cultural factors that are relevant to teaching and learning. There is great difficulty in measuring cognitive changes because it is hard to quantify thoughts and understanding concretely. The neglect of learning through experience is a challenge since this theory might not give enough importance to learning through direct experience. It must be noted that experiential learning can be a powerful tool for gaining knowledge.

The Cognitive Learning Theory frequently overlooks the role emotions play in learning. It also ignores emotional influence on learning, over-emphasis on mental processes, and lacks cultural considerations. It is also difficult to measure cognitive changes and neglects to learn through experience because it overemphasizes mental processes and tends to focus too much on mental processes like thinking and memory, while other aspects of learning can be equally important.

This theory lacks cultural consideration which is an important factor in teaching and learning. As a result of the limitations associated with the cognitive school, social constructivism emerged.

Social Constructivism

Eggen and Kauchak (2019) and Kay and Kibble (2016) have espoused constructivism as the most relevant theory undergirding the online students' processes. Although two main types are explored in this literature: The cognitive and the social constructivism theories, this study heavily explored the social constructivism theory. Kay and Kibble (2016) resolutely affirmed that learning is the

internalization and adoption of external experiences. They further added different social frameworks are essential to learning principally because knowledge and skills are cultivated through constant interactions and reciprocation. These social frameworks frequently provide comfortable environments for teaching and learning. Thus, students can optimize their abilities and are unafraid of accepting and confronting challenges. Furthermore, Kay and Kibble (2016) opined that students highly appreciate and value information that is relevant, pertinent, and viable and this enhances teaching and learning. They further stated in the last decades many educators have relied heavily on the fundamentals of social constructivism and sociocultural theory. This is obvious because there is an increase in group dynamics, and this is complemented by heightened cognition. Social constructivism and sociocultural theory also affirm genuine learning activities because students are instructed in environments with which they can identify and appreciate. Hence various situations, even though they are complex and convoluted, are realistic cases and students can value them. This becomes even more meaningful since convoluted scenarios are presented in stages and students can chart and monitor their progress. Some of the instructional constructs related to social constructivism include group projects, group learning, co-operative learning methods, zigzag methods, scaffolded learning goals, peer tutoring, and learning.

Social Learning

Bandura (1977a) captured the essence of online learning theories with his seminal works during 1977. This social learning theory principally espouses that observation and imitation are bounded and critical to the learning process. Students in the online environment are likely to observe the behavior of successful peers and imitate their behaviors with the hope of achieving similar successful outcomes in their study at the tertiary education level. Bandura (1977a) also posited that four key processes are required in social learning. They are attention, retention, reproduction, and motivation. Attention refers to the ability of students to focus properly on given behaviors. Retention addresses the capacity to retain actions that are observed. Reproduction is the replication of observed behavior and motivation is the decisive factor in determining whether or not behaviors will be reproduced. When behaviors are positively reinforced, this provides clear indications that the given behaviors are acceptable and can be reproduced (Eggen & Kauchak, 2019). The opposite is also true. Bandura's theory is one of the imperative corner blocks for the positive impact of online learning environments. He believed that from the perspectives of experienced teachers, students are likely to repeat positively reinforced social behaviors that were observed and possibly learned.

Self-Concept

Bandura's (1977b) theory about self-efficacy is also imperative for the positive impact of the online learning environment on the performances of students. It refers to the belief that people hold in their capability to succeed with given tasks or situations. Factors that are important in positive self-efficacy include past experiences, social modeling, and oral persuasion (Bandura, 1977b). Once people have successfully mastered these experiences of online education, they are more likely to adopt this different approach to learning. Mart van Dinther (2011) presented an opposing perspective. Some of his colleagues researched the link between education and self-efficacy. Their conclusions stated that self-efficacy is linked to factors such as the strategies that students utilize, the goals that students set out for themselves, and their academic achievements.

Marsh et al. (2005) and Skaalvik and Valås (1999) stated that a positive self-concept encompasses beliefs that persons have about themselves. Byrne (1996), Casey et al. (2001) Sarouphim and Chartouny (2017) affirmed this position and further noted there is a positive correlational relationship between academic self-efficacy and academic achievement. Furthermore, Ercikan et al. (2005) posited that the efficacy that students enjoy in the study of Mathematics is evident in achievements. She also noted that the attitudes of students toward the study of Mathematics were the highest predictors of participation in advanced mathematics courses. Marsh et al. (2005) affirmed that the reciprocal effects model is important because the former self-concept frequently influences achievements in the present and even the future. This position is also supported by Calsyn and Kenny (1977). However, they provided empirical evidence that demonstrates that the converse is also accurate. Thus, the skill-developmental model affirms that academic self-concept results from academic accomplishment.

Online Learning

Hendricker and Viola (2017) together with Kim (2020) clearly indicated that online learning refers to instruction that can be delivered electronically through various multimedia and internet platforms and applications. Wang and Wang (2020) stated that two basic forms of online education exist: Synchronous and asynchronous teaching. The synchronous form occurs when all participants are in a similar place at the same time. Computers and software are used for audiovisual correspondence. It is the mode of teaching in which students receive feedback instantly.

Asynchronous teaching is online, but this means that both educators and students must be online simultaneously. Educators provide different types of pre-packaged learning materials such as videos. Students engage in study activities. Assessment occurs and feedback is given subsequently. In this empirical study, the synchronous form of education was explored. Several advantages and limitations were associated with this type of educational experience, namely: the flexibility concerning time and space (Lovillo & Gidi, 2021) and students' choice of their study environment (Muthuprasad et al., 2021). Kim (2020) postulated that individualized instruction is more prevalent. Additionally,

students in the tertiary education sector in Trinidad and Tobago have alluded to advantages such as student autonomy (Dookwah & Julien, 2020; Lovillo & Gidi, 2021), immediate feedback when using the LMS, financial gain (Dookwah & Julien, 2020; Lovillo & Gidi, 2021), reduced prejudices and less exposure to negative experiences through late night travel to home after classes (Dookwah & Julien, 2020). Limitations associated with the synchronous type of education are internet bandwidth interruptions, faulty software (Dookwah & Julien, 2020; Lovillo & Gidi, 2021), interruptions by family members during study time (Brodanac & Novak, 2023; Dookwah & Julien, 2020) and lack of social skills development within learning activities (Dookwah & Julien, 2020; Lovillo & Gidi, 2021). Given that the historical transmission of education to students from the Caribbean is through hearing and seeing live demonstrations of their teachers, the immediate switch to the synchronous type of teaching can cause challenges for students.

Challenges in Learning Mathematics Online

Bringula et al. (2021) noted the challenges of learning Mathematics online fall into five categories. They are technological issues, individual circumstances, domestic limitations, institutional rules, and community barriers. Some of the issues that students have with technology are the lack of proper devices and limited gadgets. In many instances, there are poor connectivity and unreliable internet services. Students lack technical skills and are unfamiliar with most online learning platforms (Anderson & Gronlund, 2017). It was not easy for some students to overcome the challenges they experienced with online learning. Their various styles and expectations had to be addressed rapidly since learning was done in an individual model. Students had to apply themselves more and concentrate on their studies to be successful. Teaching and learning online was very demanding and complex and many students were unable to cope effectively with the daily uncertainties, stress, and anxieties. Many complained of feeling unwell and had severe headaches and mental problems because of the prolonged time of heavy concentration. To further compound this scenario there was procrastination and distractions and they were unable to maintain their object and accomplish desired tasks.

Anderson and Gronlund (2017) in their research noted that students often complained that there was limited space at home, and it was not conducive for studying. There was a lot of noise and sibling rivalry that disrupted their concentration. Some of them had to fulfil household chores do extra jobs and simultaneously attend classes online. Anderson and Gronlund (2017) claimed that many educational institutions were ill-equipped for the delivery of online education especially in Mathematics and did not even have the basics. Some of them were not even prepared and educators lacked the fundamental skills to deliver lessons. These educators were even unable and sometimes unwilling to provide assessment and feedback. Frequent power outages, excessive cognitive load, poor connectivity, and limited interaction with peers and educators further exacerbated the teaching and learning of Mathematics.

Baticulon et al., (2021), Fabito et al., (2021), and Ariyanto (2017) stated that technological, personal, institutional, and community barriers are identified with online learning. Ariyanto (2017) carefully noted that low positive attitudes, unsupportive environments, and even negative approaches of educators are just some of the factors that grossly hinder the teaching and learning of Mathematics online. Regmi and Jones (2020) stated that the debate concerning these challenges continues. This paper addressed some of the challenges that students encounter when pursuing undergraduate Mathematics online.

METHODOLOGY

Research Paradigm and Design

Creswell (2013) resolutely stated that a qualitative methodology is suitable when a deeper understanding of a phenomenon is the objective of the study. He further noted that researchers frequently adopt a thorough approach to understanding the different perspectives of participants. This empirical research conformed to the qualitative and more specifically, the phenomenological approach. Qualitative methodology is also used when researchers want to accurately comprehend everyday life experiences (Leedy & Ormrod, 2018; Sloan & Bowe, 2014). Further, Creswell and Poth (2017) and Busetto et al. (2020) strongly advocated that a qualitative methodology is significant in trying to gather in-depth and meaningful perspectives about a phenomenon. In addition, a qualitative methodological approach is appropriate for studies that seek to collect and analyze non-numerical data (Bazen et al., 2021; Yadav, 2022). Since this research is non-numerical it explored a qualitative methodological approach to properly evaluate the various perspectives of these undergraduates at Prosperous University. As a result, this qualitative research adopted a phenomenological design to capture their diverse opinions and experiences as they pertain to the challenges with the study of Mathematics.

According to Creswell and Poth (2017), a descriptive phenomenological study frequently describes several patterns of the significance of the lived experiences of a concept or phenomenon. Thus, this research design is chiefly based on the importance of the experiences of these undergraduates and suspends all suppositions (Creswell & Poth, 2017). Given the nature of this descriptive phenomenological research approach, open-ended questionnaires served as the primary research method to collect data. Other research methods, such as surveys, focus groups, and observations, are either inadequate or not applicable to accurately evaluate the lived experiences of these undergraduates (Bazen et al., 2021; Yadav, 2022) and thereby were not selected for this study. In support, Busetto et al. (2020) and Creswell and Poth (2017) vociferously believed that reflecting on

one's lived experience broadens the perspectives on a concept or phenomenon. Therefore, using open-ended questionnaires to conduct this phenomenological study was most appropriate to adequately investigate the stated research questions and to effectively facilitate the sharing of diverse perspectives and lived experiences. As a result, this contributed significantly to ensuring that the results of this study are credible, transferable, dependable, and provable (Busetto et al., 2020; Creswell & Poth, 2017 & Guba, 1981). According to Bazen et al., (2021) and Yadav (2022) several studies that utilize phenomenological inquiry appreciate and value this structure of the research design because it is rigorous, critical and systematic.

Member Checking

Birt et al. (2016) postulated that member checking often assists to verify and affirm the credibility and trustworthiness of qualitative results by involving participants in the process of checking and confirming the results. Therefore, this study allowed the undergraduates to confirm the accuracy of their interpretation of the results. This approach to member checking using synthesized analyzed data significantly contributed to credibility and reliability in the data analysis and interpretation process (Birt et al., 2016). This was because the undergraduates could recognize and affirm the accuracy of their own lived experiences. In addition, the member-checking approach allowed the students to suggest any modifications and address any gaps found in interpreting the results, thus affirming the credibility and trustworthiness of the findings (Harvey, 2015). This approach to member checking using synthesized analyzed data was most suitable for a study of this nature, given its phenomenological research design that establishes credibility by exploring whether the study's results truly represent participants' lived experiences.

Data Collection and Ethical Consideration

Seventy-two students participated in this research, fifty females and twenty-two males. Thirty-eight were single, fourteen were married, ten were in a common-law relationship and ten were in a category classified as "other". A convenient sample was chosen from all undergraduate students who were pursuing the first Mathematics course at the university. The open-ended questionnaire was distributed to all undergraduates. It is important to mention that 225 students registered for the online Mathematics course and experienced the phenomenon, through the Learning Management System called Google Meet. Seventy-two students completed the open-ended questionnaire. The data collection process lasted two weeks. Students were granted permission to use their data anonymously for the report of the study. An official letter was sent via email to all students to seek permission to conduct this research. The letter clearly stated the purpose of the research and indicated that participants were free to withdraw from the study at any time. Participants were also given the assurance that they would receive a copy of the results. The authors assured participants that confidentiality and anonymity were maintained at all stages. This was accomplished using pseudonyms in reporting and using the data collected (Omodan & Ige, 2021). The design of the questionnaire comprised five demographic questions with ten semi-structured items. Participants were invited to type comprehensively, and honestly and remain focused in sharing their experiences of the barriers to the learning of undergraduate Mathematics at this tertiary education institution.

Data Analysis

Ritchie et al. (2014) stated Thematic analysis (TA) is useful principally because it identifies, analyses, and records themes that appear in the information gathered. Creswell (2013), Bogdan and Biklen (1982) and Eddles-Hirsch (2015) also recommended a four-stage approach when analysing data: Type data into the Excel processing programme on the computer, data is reduced by grouping sub-themes in similar groups, identify relationships among sub-themes and list major themes. Data for this empirical study were analysed in four major stages: In the first place, the data were typed into the Excel processing programme on the computer. Secondly, data were reduced by putting sub-themes into similar groups. Thirdly, relationships among themes were identified, and finally, major themes were listed (Bogdan & Biklen, 1982; Eddles-Hirsch, 2015).

RESULTS

Researchers noted that only 72 students out of 225 completed the questionnaires. This could probably conform to the lack of research culture within Trinidad and Tobago. The ages of the respondents are represented in Figure 1 below.

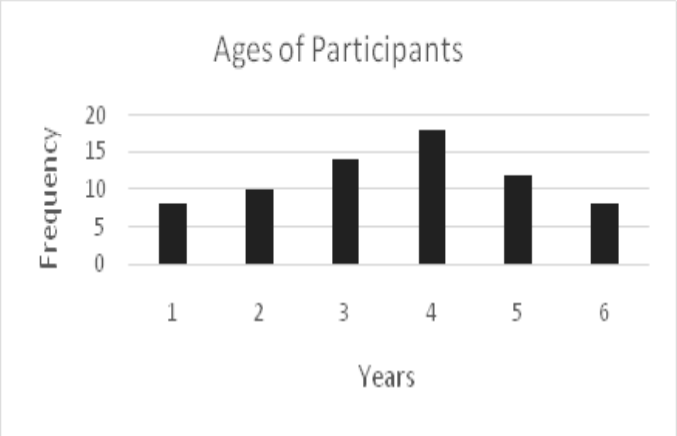

Figure 1. Ages of Participants

Most of the participants were in the 30-35 years category, while the smallest number was in the age group of 40-45 years old. The 30-35-year-old age group is likely to spend more years within the tertiary education system, and hence policymakers need to include this cohort in the decision-making policies for higher education practice. The gender of participants is represented in Figure 2 as follows:

Gender of Participants

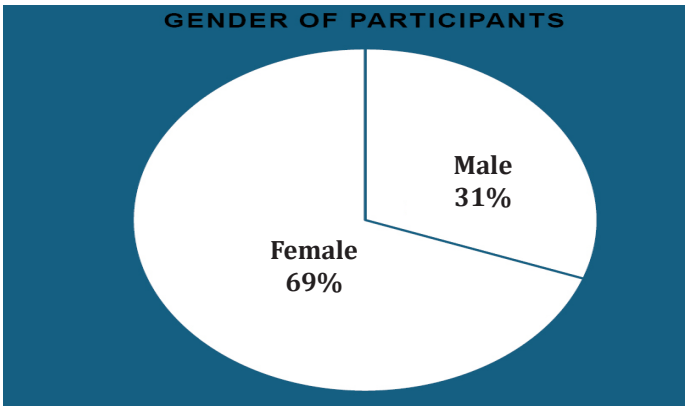

Figure 2. Gender of Participants

The gender of participants is represented in the pie chart above. The dominant gender was the female at 69%, while the males were 31% in total. Females doubled the number of male participants in the study. The ratio of females to males mirrors the relationship of males to females at tertiary institutions generally. Once again, policymakers can improve the online dissemination of education, more so in Mathematics education if they include students in policy-making decisions. Further, the demographic data also revealed that 87.5 percent of the participants own their devices which they use online. Approximately 5.5% of the participants use their cell phones to participate in online classes. It was also found that 85% of the participants depend exclusively on educators to enhance their knowledge of Mathematics online, while seven percent were happy to announce that they consider themselves independent thinkers in the Mathematics class.

At the beginning of the data-gathering exercise, students were asked to introduce themselves and describe their proficiency in Mathematics. Most of them alluded to the fact that they were very weak and were not proud of the low grades they obtained at secondary school. This could be an indication that these learners were somewhat apprehensive, uncomfortable, and unsure in the class. Thus, it could be deduced that they probably have a poor self-concept where the learning of Mathematics online is concerned.

Students also admitted that they looked forward to the online learning experience because they found it to be a convenient and inexpensive way to accomplish their life goals of earning a degree at the university level. Most of them felt that they could be successful if they were committed and dedicated and attended and participated in classes regularly.

DISCUSSION

Self-Concept

These undergraduates expressed that they like to feel valued and appreciated. Moreover, they were elated when their contributions were seen as relevant and meaningful. This does not happen with learning Mathematics Online. It is the total opposite. When questions are asked, they seem to be invalid and unimportant. Thus, students are reluctant: "to ask personal questions and seek clarification and understanding." This contributes to a total lack of motivation among students and towards the learning of this subject. These undergraduates believed that: "learning Mathematics outside of a classroom setting has too many distractions and Mathematics requires a lot of attention." As a result, they were unprepared for classes and lacked motivation and zeal. These students also provided this apt summary. "Lack of enthusiasm or self-motivation among students." "Students who are not focused refuse to participate." These findings contrast with those of Kim et al. (2014) who found that students who studied Mathematics online were self-motivated and were destined to be more successful than if they pursued face-to-face classes in Mathematics.

Preconceived Notions of Mathematics

Most of the undergraduates emphatically admitted that they had a mental block for Mathematics and did not have the proper attitude and frame of mind to study and even appreciate the subject. They all concurred that: "students fear Mathematics." They also claimed that: "Many students find the subject to be a waste of time for they do not see why they need such difficult Mathematical concepts when they won't use them in everyday life, so they close off they minds to the subject." Thus, they were reluctant to collaborate and cooperate during classes and this further cemented that mental block. It was unsurprising that they reported late for classes and were often unprepared to contribute to the teaching and learning process. They affirmed that there was a: "lack of opportunities for students to be interactive and display how much they learn from a concept or topic," and a "lack of common interaction." They also admitted that this mind block was complicated because there was a: "lack of communication," and they preferred to remain: "hidden away behind their computer." It is not surprising that the felt that the: "courses were sometimes long, boring, uninterested and tedious." These preconceived notions of Mathematics extend beyond the classroom and students do not even want to do the corresponding homework. Yet they vehemently claimed that: "there is a lack of motivation among students." These preconceived notions can be translated into fear. They categorically admitted that: "students fear Mathematics," and "lack Arithmetic ability." They are terrified to participate in class. They feel inferior and intimidated and are often innocuous and cautious: "of giving the wrong answers." They provided this possible explanation: "due to the lack of face-to-face contact in classes, students may be shy when speaking to individuals they have never seen."

Lack of Technology

Almost half of the students vehemently lamented that they lacked fundamental skills in technology. There was extremely poor connectivity which frequently fluctuated. A student admitted that: "technological equipment did not meet the demand." Another affirmed this position and mentioned that: "Sometimes there were technical issues with the

platform." They also claimed that: "not all lecturers knew how to use the online platform properly, and this hindered how the information was brought across." Hence, there was a complete disconnect. There was a: "lack of learning resources," and various postings and recordings were not done in a timely manner. Both students and lecturers were ill-prepared and unable to navigate the internet, especially when classes were conducted via Zoom. Hence, it was virtually impossible to source relevant documents or even open them. This heightened anxiety among students and raised their apprehension towards Mathematics. To further compound these scenarios, they were frequently distracted by external noise from the environment and could not concentrate on classes. Bringula et al (2021) also reported the extreme volume of noise frequently interrupted students as they pursued educational goals online. They also suggested that it may be necessary to advise students to register for courses when they know silent time is available at home for them to focus on their academic pursuits rather than competing with noises during online instruction in the Mathematics class. In addition, a student explained that: "the surroundings at home, let you feel too comfortable; so, the brain feels lazy." Further during classes: "Too many persons responded collectively to a question and did not allow the others to participate."

Group Dynamics

The interaction of students is severely restricted because there is: "limited time spent on each topic based on the two-hour class time, once per week." The opportunities for group dynamics are almost non-existent. Lecturers must be abreast and meet deadlines and hence group dynamics are grossly diminished. This does not auger well because: "students quickly lose attention and interest in the subject." They are reluctant and reticent to collaborate and participate in classes. The teaching and learning process of Mathematics is boring and unappealing. Hence, classes are viewed as: "very lengthy and not properly formatted," and students are: "not focused and are easily distracted. There is a: "lack of interaction with students and lecturers," and a "lack of motivation or concentration." The teaching and learning process of Mathematics is grossly hindered and cognition is not evident.

Teaching Styles

These seventy-two undergraduates were unimpressed with learning Mathematics Online. They complained bitterly about the teaching styles. They postulated that: "there was not enough time to explain or go in depth of certain topics that need physical explanation." The lecturers were aloof, unapproachable, and unfriendly and: "did not value the opinions of students." They were unsociable and uncongenial to such magnitude that they did not: "share relevant information in a timely manner." This frequently hindered the teaching and learning process of Mathematics. These undergraduates further lamented that they felt distant from the lecturers and did not satisfy that little desire they had for Mathematics. Further, these lecturers: "did not take proper time to interact sufficiently with students," nor did they: "entertain personal questions which could lead to possible clarification and understanding." In general, the lecturers were constantly concerned with completing the syllabus at any cost even if students were left unattended and did not comprehend and grasp a concept. This type of behaviour significantly contributed to a: "lack of in-depth explanation on certain questions asked about topics or a problem." These scenarios were further aggravated and exacerbated because many: "lecturers were very impatient and not clear in their delivery." Students lamented that they suffered because: "Topics were not clearly explained."

"Not all lecturers know how to properly use the online platform, this may hinder how the information is brought across."

Ineffective Assessment Practices

Lecturers did not execute the teaching of Mathematics adequately and properly. This compounded and cemented the lack of motivation or concentration in this subject. Although students admitted they did not like the subject they appreciated sufficient, and accurate assessment in their study. They sorely lamented that the lecturers: "do not keep proper records of students' work,' and 'do not grade it properly." Lecturers are not dynamic and creative in the classroom and do not provide sufficient practice in the subject. They also claimed that success in Mathematics is largely dependent on these various practice exercises in Mathematics because they reinforce concepts, especially abstract ones. There must be a good balance among theory, practice, and assessment since they complement each other.

The results clearly demonstrated that students feel Mathematics is a difficult subject to understand, especially when learning online. However, they are not too bothered by these difficulties because, during online Mathematics classes, they can be more flexible in the strategies they use to learn Mathematics. In addition, they also tried to retrieve and learn Mathematics concepts from alternative resources. The way students deal with the explanation of material that is not clear from the lecturers shows students' adaptability. Some students show good adaptability even though they find Mathematics difficult because they have a way to find other learning resources besides the material presented by the lecturers. For example, the use of YouTube videos as a main resource often clarifies ambiguity.

When asked how students deal with material from the lecturers that they don't understand, they remarked: "I watch YouTube videos or seek enlightenment from social media like Google." Students with high adaptability even took advantage of online meeting platforms and online breakout rooms to further discuss concepts and issues they did not understand. They also appreciated the ability to: "Repeat learning videos, sample questions are given by the teacher or find ways to do easy questions from learning applications.".

Limitations

This research was only conducted in one tertiary education institution among 72 students, so it cannot be generalized to describe the overall Mathematics resilience of students in Trinidad and Tobago. This study also uses participants who may not represent all students. However, the decision on the number of participants is still in the principle of qualitative research. The limitations of this study open opportunities for further research. Researchers can use a larger population and include diversified tertiary educational institutions. They can also use a mixed methods approach to obtain a deeper scientific outcome. They can also investigate in further detail the factors that contribute to the resilience and success of students while learning Mathematics online.

CONCLUSION

The researchers tried as far as possible to maintain the focus and adequately answered the research question: What challenges do undergraduate students experience when learning Mathematics online? By properly addressing the research question they carefully presented the challenges students experience with the learning of Mathematics online. This action research afforded the researchers the flexibility to interact informally with these undergraduate students in their natural environment. Hence the students responded without inhibition about their various experiences. The use of semi-structured questionnaires also permitted the researchers to maintain validity and reliability. Data were collected, collated, triangulated, and documented in a narrative form using six major thematic themes: self-concept, preconceived notions of Mathematics, lack of technology, teaching styles, group dynamics, and ineffective assessment practices. Limitations were noted and recommendations were offered.

RECOMMENDATIONS

Based on the aforementioned, the following recommendations are offered:

- At the beginning of each semester, educators need to professionally assess the self-concept of students.
- Educators can engage in meaningful activities to boost the self-concept of these students. This will certainly enhance their esteem and motivate and energize them to appreciate the learning of Mathematics. Since this is a dynamic and continuous process educators ought to be very alert in their evaluation and feedback provided to students.
- Both students and educators need to be acutely mindful of the teaching and learning environment online. This is necessary since the constant noise and frequent disruption of classes do not enhance the learning of Mathematics online.

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